SOIL TEMPERATURE AND WHEAT.

Farmers' Bulletin 1224, "Wheat Scab and its Control," brings out the following facts in connection with the relation of temperature to growth of plants and development of scab.

Wheat seedlings grow best and develop into stocky, healthy plants with a well-developed root system, when the temperature of the soil is about 40° to 60° F. On the other hand, the wheat-scab parasite is a warm-weather fungus, and grows best where the air and soil temperatures are about 70° to 84° F.

The seedling blight develops chiefly from the scabbed kernels sown with the wheat. A warm and comparatively dry soil favors the development of the seedling blight, while a warm, moist air favors rapid growth of the fungus. Warm rainy weather during flowering greatly favors the development of the head blight.

By seeding winter wheat at the latest safe date in the fall, and spring wheat at the earliest safe date in spring, when the soil is moist and cool, with a soil temperature of about 40°, the conditions are most favorable for the development of a good stand of deeply rooted, vigorous wheat seedlings, free from seedling blight. Such plants develop rapidly and mature early.—*J. W. S.*

RELATION OF SOIL TEMPERATURE TO ONION SMUT INFECTION.

Onion smut was first noticed in the Connecticut River Valley in 1869. Since that time it has spread throughout the northern onion growing sections from New York to Oregon, but has not appeared in the southern producing areas of Louisiana and Texas. This segregation of the disease suggested climatic conditions as the principal contributing factor, and some experiments were conducted by Messrs. Walker and Jones, of the Bureau of Plant Industry, to determine the cause of this pronounced geographic distribution of the disease. (See *Journal of Agriculture Research*, Oct. 29, 1921, Vol. XXII, No. 5.)

It was found that some variation in infection occurred with different degrees of moisture, but the moisture conditions did not appear as a serious limiting factor in onion smut infection.

The relation of soil temperature to the development of the host and the parasite was studied under controlled conditions, which gave some very interesting and important results. Seed germinations and growth took place over a range of soil temperature from 10° to 31° C. The most rapid germination and developments of tops occurred with soil temperatures of 20° to 25° C., and the best developments of roots below 20°.

A high percentage of plants grown on smutted soil was infected at soil temperatures ranging from 10° to 25° C. A decided reduction in infection was noticed at about 27°, and complete freedom from the disease resulted at 29°. The air temperature was uniformly from 15° to 20° C.

Successive out-of-door plantings at Madison, Wis., made in inoculated soil during the growing season, resulted in a gradual reduction of infection as the season advanced and the soil temperature rose. Complete freedom from smut was attained when the daily mean soil temperature at 1 to 2 inches depth remained at or slightly above 29° C. for two or three weeks. There was also a tendency, as the temperature rose, for the seedlings to outgrow the disease by the sloughing off of the diseased cotyledons before infection of the first leaf occurred.

It appears that the regional distribution of onion smut in the United States is conditioned upon the soil temperature during the seedling stage of the plant's growth, the infection and development of smut being favored by the relatively low temperatures and inhibited by the high temperatures, with approximately 29° C. as the critical point.—*J. B. K*

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HEAVY SNOWSTORM IN SOUTHERN MICHIGAN, NOVEMBER 8-9, 1921.

D. A. SEELEY, Meteorologist.

[Weather Bureau, Lansing, Mich., Dec. 23, 1921.]

The heaviest snowstorm ever recorded in this vicinity occurred November 8 and 9, 1921. The total fall at Lansing was 18.9 inches in less than 36 hours.

The storm was not only unusual as to the amount of snowfall, but also from the fact that it came so early in the season. Previous to this storm there was no record of any snowfall in November exceeding 10 inches.

The snowfall, as shown on the accompanying chart, was heaviest in this immediate section. A strip about 50 miles wide extending from east to west across the south-central part of the State was the only section where the snowfall was heavy. In the northern parts of the Lower Peninsula none was recorded and there was but little in the southern tier of counties.

The weather map on the morning of November 7 indicated the development of a low-pressure area over Colorado. The pressure was high from Lake Superior westward. During the following 24 hours the Colorado LOW moved eastward and was central on the morning of the 8th over northern Missouri, whence it moved slowly up the Ohio Valley. Snow began falling at Lansing at 10:00 p. m. on the 7th, although the center of the low area was still well to the southwestward with clear weather in the Ohio and Mississippi Valleys. Snow continued heavily all day on the 8th, with the temperature slightly below freezing. Meanwhile the high-pressure area moved southeastward over the trans-Mississippi region.

The weather map seems to indicate that moisture for the heavy snowfall was furnished by outflowing upper currents from the low-pressure area to the southwest. Temperatures were high near the storm center and moderately low in the Lake Superior region, in connection with the high pressure. The probability is that this cold air moving in from the north at the surface and mixing with the warm and moist air outflowing from the low-pressure area above produced the large amount of snowfall.

The pilot-balloon observation made at this station on the afternoon of November 7 showed a backing of the wind from north at the surface to west at elevation of 1,350 meters, where heavy St.-Cu. clouds were entered. This rather supports the theory in regard to the sources of moisture just mentioned.

The distribution of snowfall in Lower Michigan is shown by figure 1.

DISCUSSION.

By A. J. HENRY.

The phenomenon described by Mr. Seeley is of more general occurrence than might be supposed; it falls within the class of what might be called islands of greater

rainfall occurring within large areas of light and moderate rains. The best examples are found in the Gulf States and may be looked for in practically all seasons, although more common in the cold than in the warm season. This uneven distribution is common to both tropical and extra-tropical cyclones.

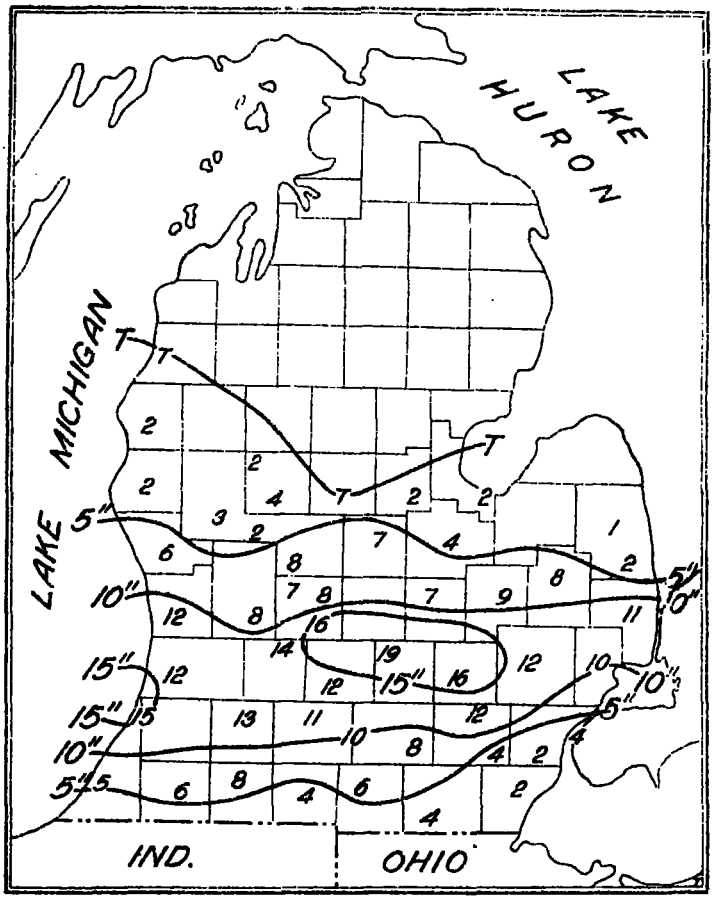

FIG. 1.—Snowfall in lower Michigan.

The source of the moisture is, of course, easy to fix, but the cause of the uneven distribution is not so easy to explain. It can not be due to surface relief because along the Gulf coast there is no surface relief worth mentioning.

In the absence of cloud or pilot-balloon observations it is not possible to determine the direction of the free-air winds over the regions of heavy rainfall, but there is every reason to believe that they are from the Gulf. In the cold season the air temperature at 3 km. level may be, and probably is, higher over the Gulf than it is over the adjacent continental area at the same level. The warmer air would then override the colder air and thus general precipitation would result. But would this be the case in tropical cyclones in which excellent examples of irregular distribution of precipitation may be found? Nothing is known of the temperature distribution in tropical cyclones. It would therefore be hazardous to place them in the same category with extra-tropical cyclones.

In the case discussed by Mr. Seeley, pilot-ballon observations made in the afternoon of the day before the snow storm show that southerly winds prevailed up to 3 km. and higher over a large area extending from Texas northeastward to the Great Lakes. That this presumably warm current from the southwest was underrun by a cold northerly current having its origin in the Lake Superior region appears to be the explanation of the heavy snowfall over Lower Michigan as shown in figure.

TORNADOES OF NOVEMBER 17, 1921, IN ARKANSAS.

By W. C. HICKMON, Observer.

[Weather Bureau, Little Rock, Ark., Dec. 9, 1921.]

SYNOPSIS.

Two tornadoes occurred in Arkansas during the late afternoon and evening of November 17, 1921, in which 11 people were killed, 39 or more injured, and nearly $20,000 worth of property destroyed. The first tornado occurred in southern Polk County and followed a west-east course; the other, starting in Clark County, moved northeastward across Hot Springs County into the southeast edge of Garland County. Both were very destructive when touching the earth; fortunately the funnel cloud seems not to have been in contact with the earth at all times, but lifted from place to place.

Preceding and attending weather.—The morning weather map of November 17 showed low pressure covering the Mississippi Valley and the Southwest, with the principal centers over Illinois and northeastern Arizona; high pressure overlay the Canadian maritime provinces and the northwestern border. The horizontal temperature gradient was steep from Kansas to Arkansas and Texas. In the evening the map showed the Arizona LOW to have increased in intensity. It was centered over New Mexico, with a trough extending northeastward across Arkansas to the Lakes, the HIGH in the Northwest moving in from the North Pacific. The temperature gradient continued steep. The pressure distribution, the marked difference in temperature over a small area of the country, and the location of the trough, all combined, made a condition favorable for the formation of tornadoes in Arkansas.

Probably two tornadoes.—While it is not absolutely certain that there were two tornadoes in Arkansas during the afternoon and evening of November 17, the fact that the first damage occurred in Polk County near 5:00 p. m. and the other did not occur until 8:30 p. m. leads us to believe that the two were separate storms. No trace of a destructive storm was found between southern Polk County and Clark County, so the two are mentioned separately.

The Polk County tornado.—The first and only serious damage done by the tornado in Polk County occurred about 1 mile west of Wicks when the home of R. E. Weems was totally destroyed and its eight occupants killed, their bodies being strewn along the storm's path, one being fully one-half mile from the place where the house stood.

Clark, Hot Springs, Garland County tornado.—Starting in sec. 31, Twp. 6 S., R. 20 W., in Clark County, and moving in a northeastward direction over a path varying in width from one-fourth to three-fourths mile, another tornado occurred which killed three people, injured 37, and did considerable property damage.

This tornado did not have a complete path from the lumber camp near De Gray to Lonsdale, but the direction of its movement and the time of its occurrence indicate that it was one and the same storm. Like the one in Polk County, the funnel-shaped cloud touched the earth only occasionally, but left destruction wherever it touched.

The Garysonia Lumber Co.'s logging camp, near De Gray, Clark County, was struck about 8:30 p. m. and was torn to shreds by the storm's fury, only splintered timbers remaining of the shacks and boarding cars in which the lumbermen and their families lived. In this